An Overview of Maxillofacial Trauma in Oral and Maxillofacial Tertiary Trauma Centre, Queen Elizabeth Hospital, Kota Kinabalu, Sabah

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Abstract

The aims of this study were to provide an overview of maxillofacial trauma and its relationship to patient's demographic data and alcohol consumption within the state of Sabah. It was a retrospective study of maxillofacial trauma cases treated by Oral and Maxillofacial Surgery Department, Queen Elizabeth Hospital, Kota Kinabalu, Sabah, from January 1, 2009, until December 31, 2013. A total of 630 maxillofacial trauma cases were included. Details of the trauma were collected from patients' record, including patients' cause of injuries, injuries suffered, treatment indications, and treatment received. Patients' demographic data (age, gender), alcohol consumption in relation to causes, and type of maxillofacial injury were analyzed. There were 538 male (85.4%) and 92 female (14.6%) patients (ratio: 5.8:1), with mean age of 31.0 years. Most common causes of maxillofacial injury were motor vehicle accident (MVA; 66.3%), followed by fall (12.4%) and assault (11.6%). Motorcyclists made up more than half of the total cases (53.1%). Cases referred were primarily due to soft-tissue injury (458 cases). Other cases were dentoalveolar and maxillofacial bone fractures. Treatment provided for the fractures included open reduction and internal fixation (22.9%), closed reduction (28.7%), and conservative management (48.4%). Toilet and suturing were done for all patients with soft-tissue injury. Maxillofacial trauma is a major problem in Sabah. It affects mostly males in the age group of 21 to 30 years. Most of the MVA patients were motorcyclists. Mandibular fracture with parasymphysis involvement recorded the highest number. Most of the patients preferred conservative management, probably due to financial and logistic issue.

Keywords
- maxillofacial injury
- zygoma
- maxilla
- mandible
- ORIF
- closed reduction

Maxillofacial injury has become one of the major health problems worldwide, and injury patterns vary in different societies.[1,2] The incidence varies according to geographical area and socioeconomic status of the population investigated.[3] This group of patient is a huge burden and workload for maxillofacial surgeons,[4] due to many vital structures and significant aesthetic consideration of the facial area.

Different etiologies of maxillofacial injuries had been reported in the literature, which include motor vehicle accident (MVA), assault, domestic injury, sport injuries, and others. Due to the differences in social, culture, environmental, and risk factors, both the incidence and the etiology of the trauma vary from one country to another.

Assault and MVA are the two main causes of maxillofacial injury worldwide.[5] Injuries at maxillofacial regions stemming

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from MVA continue to be the leading cause in many countries.[1,6] It is known that the incidence of MVA is even higher in developing countries, which ranged from 55.2 to 91% as reported in the literature.[7–12] MVA is the main etiology and the second cause of mortality, particularly in Southeast Asia. Malaysia is not spared from the maxillofacial trauma caused by MVA, with the majority involved motorcyclists, as motorcycles constitute half of all vehicles and contributed to more than 60% of casualties in Malaysia.[13]

Sabah is a state in East Malaysia on Borneo Island with a population of 3.49 million. It is the second largest state in Malaysia after Sarawak and has a land area of 73,902 km^2. Until today, there is no maxillofacial trauma epidemiology study done in Sabah. Therefore, the aims of this study were to provide an overview of maxillofacial trauma and its relationship to patient's demographic data and alcohol consumption within the state of Sabah.

Materials and Methods

This study was approved by the Ministry of Health, Medical Research Ethnics Committee (MREC). We retrospectively collected data from the medical records of all trauma patients referred to Oral Maxillofacial (OMFS) Department of Queen Elizabeth Hospital in the span of 5 years from January 1, 2009, until December 31, 2013. The inclusion criteria included all trauma patients of all ages whom had follow-up review or completed treatment. Patients who have incomplete details or history and who were initially seen but did not turn up for review appointment were excluded from this study.

Data were extracted from patients' record using a data collection form. Patients' gender, age, causes of injury, type of injuries suffered, indication for treatment, and treatment received were recorded.

Outcome Measures

The primary outcomes of the study were to report the cause and prevalence of various maxillofacial traumas in the state of Sabah and the types of treatment provided. The secondary outcomes were patients' demographic data (age and gender) and alcohol consumption in relation to the causes and type of maxillofacial injuries.

Result

For the period of 5 years, a total of 675 patients were seen in the OMFS Clinic of Queen Elizabeth Hospital. A total of 630 patients fulfilled our inclusion criteria and were included in this study. Forty-five patients were excluded because of incomplete data or patient defaulted follow-up appointment.

There were 538 male (85.4%) and 92 female (14.6%) patients with mean age of 31.0 years (ranged from 10 to 88 years). Male gender constituted the highest number in all causes of maxillofacial injury. Furthermore, only male patients (100%) were involved in industrial injury. As high as 93.2% of cases reported under the category of assault were male patients. Out of the total 406 patients involved in MVA, 351 patients were also reported by male gender.

In all categories, higher percentages of male (19.1%) injuries were related to alcohol compared with just 3.7% of female population. Regardless of gender, 23.3% of the assaulted cases were under alcohol influence. In fact, MVA under alcohol influence causes the most number of patients with the maxillofacial injuries, 78 patients in total, inclusive of both genders. None of the patients with industrial injuries were reported under alcohol influence during the incident.

In terms of patient's age, older patients with maxillofacial injury were mostly due to alleged fall. Maxillofacial injuries from sports occur in the younger age group of patients with a mean age of 23.3 years (►**Tables 1** and **2**; ►**Fig. 1**).

For the anatomical areas involved in maxillofacial injuries (►**Figs. 2** and **3**), the total number of areas involved exceeded the total number of 613 patients; the reason is that some of these patients sustained multiple sites of injuries in a single incident. A total of 458 patients suffered soft-tissue injuries (mean age of 31.0 and standard deviation of 14.6). Among these patients, MVA contributed a total of 300 patients, followed by alleged fall with 55 patients and alleged assaulted with 51 patients. Of the total patients, 86 patients (18.8%) with soft-tissue injuries were reported to be under alcohol influence during the incidents.

For the maxillofacial bone structure, mandibular bone fracture recorded the highest number. A total number of 193 patients were reported with mandibular bone fracture, which composed of 171 males and 22 females. A total of 133 patients (69%) were due to MVA and 24 patients (30.8%) were reported from alleged fall. Thirty-four patients (17.6%) were under alcohol influence. Different anatomical areas of mandibular fracture were recorded. The most common site of mandibular bone fracture was parasymphysis of the mandible (91 cases), while the least number was the coronoid process of the mandible (4 cases). Only 60 patients sustained dentoalveolar injuries and 10% of them were under alcohol influence.

Table 1 Sex and cause of injuries

Variable	No (%)
Sex	
Male	538(85.4)
Female	92(14.6)
Cause of injury	
MVA	406(65.7)
Assault	73(11.8)
Fall	78(12.6)
Industrial	22(3.6)
Sport	18(2.9)
Others	21(3.4)

Abbreviation: MVA, motor vehicle accident.
Note: Differences in category totals due to loss of data.

Table 2 Different cause of maxillofacial injury based on gender distribution

Variable	No (%)
MVA	
Male	251(86.5)
Female	55(14.5)
Assault	
Male	68(93.2)
Female	5(6.8)
Fall	
Male	54(69.2)
Female	24(30.8)
Industrial	
Male	22(100)
Female	0(0)
Sport	
Male	15(83.3)
Female	3(16.7)
Others	
Male	19(90.5)
Female	2(9.5)

Abbreviation: MVA, motor vehicle accident.
Note: Differences in category totals due to loss of data.

Dental injuries were recorded in 148 patients, of which 81% of them were males. MVA contributed the most number of patients, followed by alleged fall and only one patient sustained dental injury in sport activity.

Some patients were under alcohol influence during the mishaps. Among 406 patients, 78 of the victims were under alcohol influence; 17 patients from the total of 73 patients involved in assault; 8 among the 78 patients alleged fall; and among 18 patients involved in sports-related injury, 1 was under alcohol influence (►**Table 3**; ►**Figs. 4** and **5**).

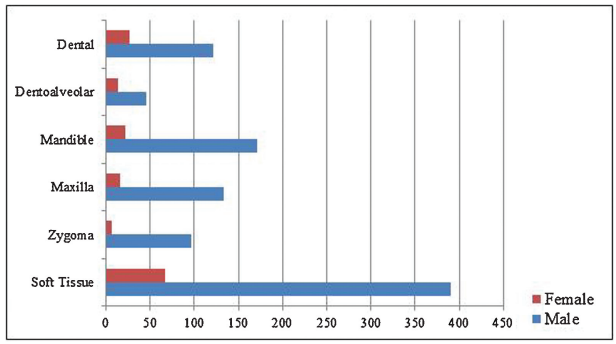

Fig. 2 Areas of maxillofacial injuries based on gender distribution.

Discussion

The key findings of this study were males constituted the higher number in maxillofacial trauma cases compared with females; highest incidence of maxillofacial trauma cases came from the age group of 21 to 30 years; the main cause of maxillofacial trauma incidence in Sabah was MVA; motorcyclists formed the highest number of the MVA victims; most of the maxillofacial injury patients presented with soft-tissue injuries, followed by mandibular fracture; and most of the patients chose to have either conservative management or no treatment.

From the demographic data of maxillofacial trauma, it was shown that maxillofacial fractures were significantly more prevalent in men (538 males, 85.4%) compared with women (92 females, 14.6%). Male-to-female ratio was 5.8:1, a higher ratio compared with study by Fasola et al, Nobrega et al, and Bayan et al.[1,14,15] However, the ratio of our study was lower than 13:1 as described by Moafian et al in a study performed in Iran.[16] These findings demonstrate a lack of established pattern across cultures.[1] The cultural and socioeconomic values of population studied might influence the rates of facial fractures in women.[5] For work-related accidents, men tend to have a higher-risk job as compared with women. Occupation involving physical strain or the use of tools and

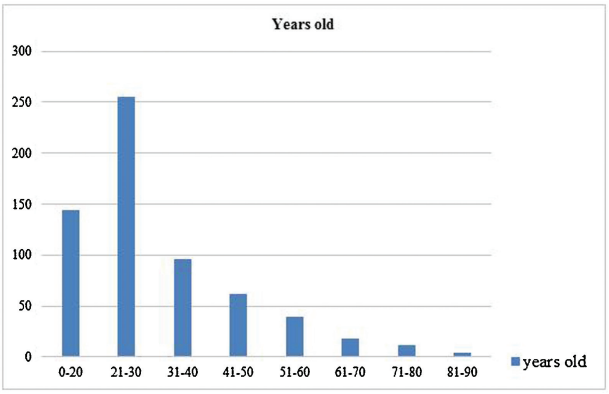

Fig. 1 Age distribution of subjects in the study.

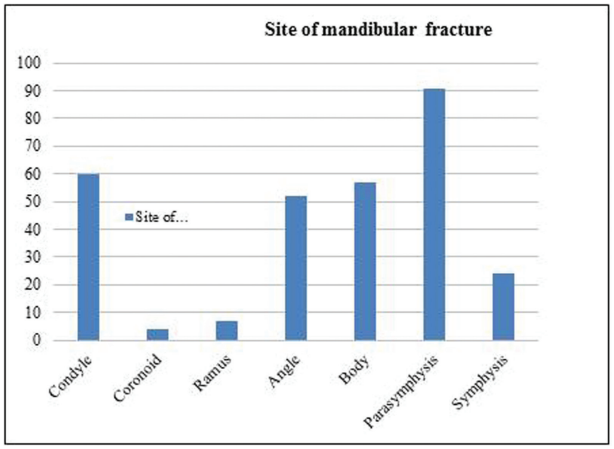

Fig. 3 Distribution of mandibular bone fracture by its anatomical region.

Table 3 Different cause of maxillofacial injury based on alcohol influence

Variable	No (%)
MVA	
Alcohol related	78(19.2)
Non–alcohol related	328 (80.8)
Assault	
Alcohol related	17(23.3)
Non–alcohol related	56(76.7)
Fall	
Alcohol related	8(10.3)
Non–alcohol related	70(89.7)
Industrial	
Alcohol related	0(0)
Non–alcohol related	22(100)
Sport	
Alcohol related	1(5.6)
Non–alcohol related	17(94.4)
Others	
Alcohol related	0(0)
Non–alcohol related	21(100)

Abbreviation: MVA, motor vehicle accident.
Note: Differences in category totals due to loss of data.

machine tend to be more dangerous.[3] In addition, men are more likely to be involved in sports and interpersonal assault. For sports-related injury, participation in team sports, higher exposure of teenage boys or young adults to sports, behavioral factors (increased thrill-seeking, willingness to take risks), and physical factors (increased muscle mass, greater force of impact) may also contribute to the observed differences between genders.[6]

Highest incidence of maxillofacial trauma was from patients within the age group of 21 to 30 years. Both gender and age group predilections were similar to the data reported

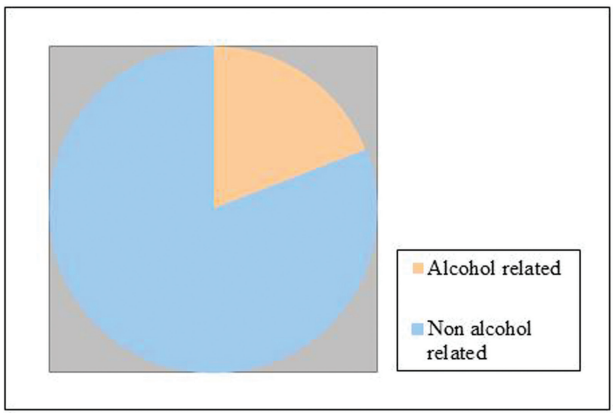

Fig. 4 Distribution of alcohol versus non–alcohol-related trauma of male gender.

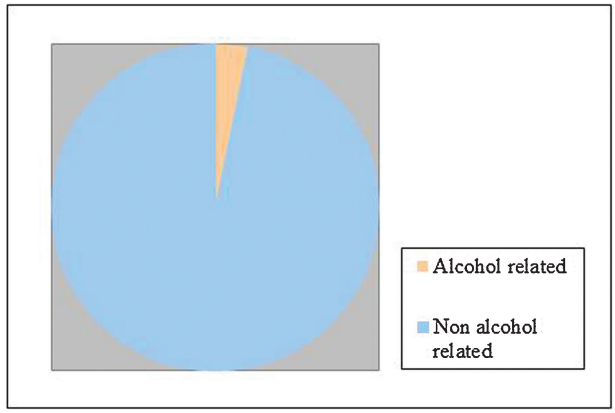

Fig. 5 Distribution of alcohol versus non–alcohol-related trauma of female gender.

in different researches done in other parts of the world.[1,3–6,11,13,17–21] It has been suggested that males, aged between 21 and 30 years, were more susceptible to maxillofacial trauma due to their high rate of commuting.[5] The youngest patient seen in OMFS department was 10 years old. In that 5-year period, there were only six patients aged 16 and younger. This was because patients younger than 16 years were being treated in the Dental Pediatric Department. Only pediatric cases that require OMFS input were being referred.

The main cause of maxillofacial trauma in Sabah was MVA followed by personal assault and fall. The result was comparable to other studies, reporting that developing countries have higher incidence of MVA, ranging from 55.2 to 91%.[7–13] Malaysia shares similar profiles of crash patterns with other developing nations in the world in the past decade. The tremendous increase of motorized vehicles on roads has invariably led to significant rise in the number of traffic accidents. Road-traffic accidents ranked fifth among the leading cause of death in Malaysia. Malaysia ranked 46th out of 172 countries in number of death in registered vehicles due to road accidents. According to the Official Web site of MIROS (Malaysian Institute of Road Safety Research), from 1995 to 2012, there were an increasing number of vehicles registered along with the increase in population. This has led to a growing number of road-traffic accidents and deaths. In year 2007, among the registered vehicles in Sabah, 15,196 cases of accidents were recorded compared with the total of 363,319 cases of accidents in Malaysia for that year. Survey of fatalities and death among vehicles registered with Road Transportation Department Malaysia (RTD) in year 2007 reported that a total of 6,282 people were killed in road accidents in year 2007 and Sabah recorded a value of 316 cases among the 6,282. The high incidence of MVA injury might be attributed to the recklessness and negligence of the driver, poor road condition, poor traffic law enforcement, and cars without safety features such as airbag, and antilock braking system. However, the etiology of maxillofacial trauma has changed drastically in developed countries in the past decade; personal assault has overtaken MVA as the main cause.[13] These findings have been reported in countries such

as Denmark, Sweden, United Kingdom, France, Finland, and New Zealand.[22–25]

Most of our MVA cases came from motorcyclist (53.1%, 222) followed by car (42.6%, 178). The result was similar to the study by Nobrega et al, which reported that the road-traffic accidents involving motorcyclists were the most prevalent (67.8%).[1,13] According to Hussaini et al, 60% of road-traffic accidents casualties were motorcyclists.[13] The incidence of helmet wearing and its impact were not discussed in this study due to insufficient patient's data recorded in this area. The mostly low-capacity (<150 cc) engine motorcycles were cheap, and used by daily commuters, who were mainly from low- to middle-income families in large towns. This is due to the fact that motorcycle offers little protection to its rider and pillion. Motorcycles are also less stable and easier to loss control. Cyclist has the lowest incidence of 0.5% (2) simply because there are not many cyclists in Sabah. Cycling is not a popular sport here and it is not a popular mode of transportation. Other causes of oral maxillofacial trauma included gunshot wound, injuries caused by animal, and injuries caused by falling tree trunk.

Most of our maxillofacial patients had soft-tissue injury on presentation (72.7%, 458/630). Soft-tissue injuries included laceration wound, abrasion or contusion on the facial region. Data of the exact anatomical location and severity of the soft-tissue injuries were not collected in this study. All laceration wounds were treated with toilet and suturing. Damaged parotid glands were normally referred to and managed by otorhinolaryngology (ORL) team. The most commonly fractured site at the face was the mandible followed by maxilla and zygoma. Mandible's prominence made it a favorable site for fracture. Parasymphysis was the most frequent site for mandibular fracture followed by condyle and body of mandible. Parasymphysis fracture is a fracture that occurs between the mental foramen and the distal aspect of the mandibular lateral incisors.[26] The anatomical location of parasymphysis around the curvature of the mandible makes it a prominent site for fracture. The thin condylar neck tends to fracture easily during an impact and this mechanism prevents it from being pushed into the middle cranial fossa. Several studies reported similar findings with our study, which mentioned that the most frequent site of maxillofacial fracture was mandible,[4,5,21] and the most frequent mandibular fracture sites were symphysis–parasymphysis and condylar region for road-traffic accident cases.

Of all our fracture cases, 100 of the patients chose to be treated with open reduction and internal fixation (ORIF), 125 cases by closed reduction, and 211 cases by either conservative management or no treatment. ORIF was mainly achieved via titanium osteosynthesis plates. All our ORIF cases were treated with load sharing mini plates with exception to comminuted mandibular fractures where load-bearing plates were used. Closed reduction was mainly achieved via intermaxillary fixation either using arch bar or eyelet wiring. With regard to treatment methods, some research had reported that approximately 98% of all patients with mandibular and middle third facial fractures were treated by closed reduction, followed by ORIF and conservative management (active jaw exercises after short period of immobilization for condylar fractures).[4] ORIF may lead to early recovery, segment stability, more rapid return of function, and also improvement of patient's comfort.[5] Indications for ORIF of zygomatic complex fractures include diplopia, enophthalmus, poor aesthetic, and limited mouth opening. We treat condylar fracture with closed reduction with exception for cases indicated for open reduction such as fractured laterally, displacement of condyle into middle cranial fossa, and the presence of foreign body. Nevertheless, patients refused ORIF treatment because of the healthcare cost. Some of the simple fractures were managed conservatively. This was particularly true for non-citizens who live below poverty threshold and were not entitled to free medical care enjoyed by the citizens. Of note, Sabah has a poverty rate of 24.2%. This might have implications to the relatively high proportion of patients refusing standard treatment for maxillofacial trauma when compared with most developed countries.

Alcohol plays a major role in MVA and interpersonal assault. Higher percentage of male injuries is alcohol related compared with female. None of the industrial related injuries is under alcohol influence. It is a policy by most employers to prohibit alcohol consumption to ensure workplace safety in accordance with Occupational Safety and Health Act 1994.

This retrospective research comes with several limitations. Incomplete data recorded in the patient's medical record has inevitably resulted in shortcoming and pitfalls in our results. Anatomical areas and descriptions for soft-tissue injuries were not properly defined which made the data collection impossible. Protective measures such as airbags, seatbelt, and helmet were not recorded in the medical record.

Conclusion

Maxillofacial trauma is a major problem in the state of Sabah. It affects mostly males aged between 21 and 30 years. MVA is the main cause of trauma with highest incidence from motorcyclist group. Most of our patients suffered soft-tissue injuries and mandible is the most frequently fractured facial bone. Meanwhile, the most common fractured mandibular site is parasymphysis. There is a huge percentage of patients with facial bone fractures who were treated conservatively or chose to have no treatment.

Road-traffic safety measures need to be actively implemented in educating the people and at the same time road traffic rules and regulations should be strictly enforced. Financial aid on medical fees and equipment should be made available to underprivileged victims to ease their burden.

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